In the long term, regulatorily-imposed inefficient pricing harms consumers of noncompetitive services. If customers have competitive alternatives, they will ultimately adopt them if the cost savings are appreciable. As competition grows, more and more customers will have competitive alternatives. The burden of inefficient pricing will, therefore, have to be borne by a smaller and smaller group of customers, who will each have to pay increasing amounts. Before that process goes too far, rates should be restructured to eliminate inefficient pricing.

## B. Underdepreciation of Plant

For decades, regulators have not allowed telephone companies to depreciate plant as rapidly as the value of the plant declines. Depreciation methods do not reflect the rapid obsolescence of high-tech equipment.

Table 3 compares depreciation of LECs with that of a variety of other high-tech firms. LECs have far less accumulated depreciation than any of the other firms. Furthermore, LECs take less annual depreciation expense (as a fraction of gross plant) than any of the other firms; so the problem is getting worse, not better.

**Table 3**
**Annual Depreciation and Amortization Expense and Accumulated Depreciation and Amortization as a Percent of Gross Property, Plant and Equipment for Local Exchange Carriers (LECs) Versus Other High-Tech Companies 1991**

| | | | | As a Percent of Gross Property, Plant and Equipment | |
|---|---|---|---|---|---|
| | Depreciation and Amortization Expense | Accumulated Depreciation and Amortization | Gross Property, Plant and Equipment | Depreciation and Amortization Expense | Accumulated Depreciation and Amortization |
| | (Thousand Dollars) | | | (Percent) | |
| | (1) | (2) | (3) | (4) (1)÷(3) | (5) (2)÷(3) |
| All Reporting LECs | $16,910,113 | $93,642,648 | $246,449,644 | 6.9% | 38.0% |
| Apple Computer, Inc.[a] | 204,400 | 588,000 | 1,036,000 | 19.7 | 56.8 |
| Xerox Corporation | 695,000 | 2,690,000 | 4,795,000 | 14.5 | 56.1 |
| Texas Instruments Inc. | 590,000 | 2,007,000 | 4,361,000 | 13.5 | 46.0 |
| Digital Equipment Corporation (DEC)[b] | 827,000 | 3,651,000 | 7,429,000 | 11.1 | 49.2 |
| Hewlett-Packard Co. | 624,000 | 2,616,000 | 5,961,000 | 10.5 | 43.9 |
| McDonnell Douglas Corp. | 499,000 | 2,948,000 | 5,255,000 | 9.5 | 56.1 |
| International Business Machines (IBM) | 5,150,000 | 28,100,000 | 55,678,000 | 9.3 | 50.5 |
| American Telephone & Telegraph Co. (AT&T)[c] | 3,568,000 | 21,203,000 | 39,892,000 | 8.9 | 53.2 |
| Litton Industries, Inc. | 219,834 | 1,214,988 | 2,525,439 | 8.7 | 48.1 |
| General Electric Co. | 2,654,000 | 13,741,000 | 32,073,000 | 8.3 | 42.8 |
| Corning Incorporated | 231,300 | 1,380,100 | 2,809,700 | 8.2 | 49.1 |
| MCI Communications Corp. | 776,000 | 3,987,000 | 9,684,000 | 8.0 | 41.2 |
| The Boeing Co. | 826,000 | 5,070,000 | 10,600,000 | 7.8 | 47.8 |
| Westinghouse | 360,000 | 2,544,000 | 5,070,000 | 7.1 | 50.2 |
| The Dow Chemical Company | 1,465,000 | 11,888,000 | 20,663,000 | 7.1 | 57.5 |

[a]Data based on Fiscal Year Ending September 27, 1991.
[b]Data based on Fiscal Year Ending June 29, 1991.
[c]AT&T is partially regulated by the FCC.
Source: All Reporting LECs: FCC, *Statistics of Communications Common Carriers*, 1991/1992 Edition, pp. 8, 38 and 41.
Other Companies: *Moody's Industrial Manual* and *Public Utility Manual*, 1992 and *Standard & Poor's Corporation Records*, 1993.

One might try to justify the low LEC depreciation rates on the basis of their investment in long-lived outside plant. However, that argument is becoming more and more strained, as high-tech fiber-optic cable is replacing low-tech copper cable. Indeed, embedded copper wire becomes worthless in an economic sense when fiber optics is deployed. Fiber optics can offer services (such as voice, data applications, and a whole host of broadband services) and requires substantially less maintenance than copper. Furthermore, fiber optics is digital and can be interconnected less expensively to digital switches and digital PBXs. All these considerations argue in favor of rapid depreciation of embedded copper plant.[70]

Depreciation in the cable television industry is relevant in this regard. Cable companies have a large fraction of their plant investment in outside plant. Like LECs, cable companies have substantial embedded investment in copper (coaxial cable) and are gradually upgrading to fiber. Table 4 shows depreciation of cable multiple system operators (MSOs) that do not have sizeable holdings other than cable companies.[71] All the cable MSOs in the table depreciate plant about two to three times as rapidly as LECs.[72]

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[70]For further discussion of this issue, *see* Michael J. Marcus and Thomas C. Spavins, "The Impact of Technical Change on the Structure of the Local Exchange and the Pricing of Exchange Access: An Interim Assessment," unpublished draft. *See also* Jeffrey H. Rohlfs, Charles L. Jackson, Harry M. Shooshan III and Susan W. Leisner, *'Miles to Go': The Need For Additional Reforms In Capital Recovery Methods*, presented at the National Economic Research Associates, Inc. Telecommunications In A Competitive Environment Seminar, Scottsdale, Arizona, April 12-15, 1989.

[71]We attempted to include as many large cable MSOs as possible in the table. However, many large MSOs, such as TCI, ATC (subsidiary of Time Warner) and Cox are excluded, since they have sizable noncable holdings.

[72]Cable MSOs have relatively little *accumulated* depreciation, since they are growing so rapidly and much of their plant is relatively new.

**Table 4**
**Annual Depreciation and Amortization Expense and Accumulated Depreciation and Amortization as a Percent of Gross Property, Plant and Equipment for Local Exchange Carriers (LECs) Versus Cable TV Companies**
**1991**

| | Depreciation and Amortization Expense | Accumulated Depreciation and Amortization | Gross Property, Plant and Equipment | As a Percent of Gross Property, Plant and Equipment: Depreciation and Amortization Expense | As a Percent of Gross Property, Plant and Equipment: Accumulated Depreciation and Amortization |
|---|---|---|---|---|---|
| | (Thousand Dollars) | | | (Percent) | |
| | (1) | (2) | (3) | (4) (1)÷(3) | (5) (2)÷(3) |
| All Reporting LECs | $16,910,113 | $93,642,648 | $246,449,644 | 6.9% | 38.0% |
| Comcast | 164,299 | 340,628 | 845,452 | 19.4 | 40.3 |
| Comcast/Philadelphia, L.P. | 16,218 | 38,207 | 97,205 | 16.7 | 39.3 |
| TCA Cable | 34,007 | 119,649 | 229,279 | 14.8 | 52.2 |
| Galaxy Cable M.L.P. | 7,479 | 26,608 | 53,531 | 14.0 | 49.7 |
| Adelphia | 79,427 | 211,599 | 580,370 | 13.7 | 36.5 |

Note: Accumulated depreciation for cable companies is derived from Gross Plant less Net Plant.

Source: All Reporting LECs: FCC, *Statistics of Communications Common Carriers*, 1991/1992 Edition, pp. 8, 38 and 41.
Cable Companies: Paul Kagan Associates, Inc., *The Cable TV Financial Databook*, June 1992, pp. 58 and 72.

Underdepreciation of LEC plant amounts to a huge sum. To put the LEC industry on the same sound footing as the unregulated firms in Table 3, regulators would need to authorize approximately $25 billion of depreciation.[73]

Underdepreciation is best understood as a giant regulatory Ponzi game. Regulators in the past have (with the best of intentions) chosen not to fund the cost of telephone service fully, but to pass part of the costs on to the next generation; the next generation of regulators

[73]The additional depreciation described above is the total amount, while the figures calculated in the previously cited Monson-Rohlfs study are annual costs. This figure includes both federal and state depreciation components.

passed an even larger burden on to the next generation; and so forth. So long as this game can be continued indefinitely, all generations of ratepayers benefit.

Unfortunately, however, the Ponzi game ends, and the bubble bursts, when competition becomes widespread in the industry. Prices in competitive markets are limited by the costs of competitors. They cannot be raised simply because regulators in the past chose not to fully fund the cost of telephone service in their generation. As more and more markets become competitive, the only choices will be to raise rates to the shrinking group of monopoly ratepayers or to deny the company a fair return on its investment. The former is inequitable and politically unacceptable; while the latter reduces LECs' access to capital markets and inevitably leads to a decline in their portion of the telecommunications infrastructure. To avoid this unpleasant choice, current regulators must deal with the $25 billion problem they inherited from past Ponzi players — before competition becomes ubiquitous.

### 1. Depreciation Under Price Caps

Increasing the rate of depreciation of an item of plant raises expenses in the short term, but decreases expenses farther in the future. Under ROR regulation, the company is afforded the opportunity to recover its prudently-incurred expenses, including depreciation. Consequently, increases in depreciation under ROR regulation translate directly into price increases in the short term. The company generally has the incentive to petition for higher depreciation rates. Higher depreciation expense, together with increased revenue to match the higher depreciation, increases cash flow in the present and reduces risk in the future. On the other hand, regulators have resisted price increases, because of the political implications of increasing short-term prices.

The incentives differ under price caps. Under pure price regulation, increases in depreciation rates are usually *not* treated as exogenous cost increases, which are flowed through to customers. Consequently, increases in depreciation do not generally translate into price increases. They simply lower the company's reported earnings. Consequently, the company has much less incentive to petition for increases in depreciation rates. Under price

caps with a sharing mechanism, part of the depreciation increase flows through to customers in the form of higher prices. Part flows through to stockholders in the form of lower reported earnings. The company's incentives to seek increases in depreciation are still less than under ROR regulation. Because of these incentives, it is hardly surprising that the problem of underdepreciation actually has gotten (slightly) worse under price caps.

Treating increases in depreciation rates as "exogenous" cost increases would be better than the *status quo*. However, that policy would simply restore the pre-price-cap incentives, which also led to underdepreciation.

The FCC recently took action to reduce unnecessary bureaucracy in the process of prescribing depreciation rates;[74] yet this action cannot realistically be expected to solve the problem of underdepreciation. If a price-cap LEC unilaterally increases its depreciation rates, it suffers a financial loss (lower reported earnings) with no commensurate compensation.[75] Consequently, it has little incentive to do so. As a result, the problem of underdepreciation is likely to persist.

Further measures are required to solve the problem of underdepreciation. The best approach is for regulators and LECs to agree on an ambitious specified schedule for reducing the value of assets on the regulatory books as part of a price-cap plan. The devaluation of assets would not correspond directly to rate increases and would therefore reduce the company's reported earnings. The Commission would therefore (*ceteris paribus*) need to make concessions elsewhere in the plan in order for the plan to be acceptable to the company.

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[74]FCC, In the matter of Simplification of the Depreciation Prescription Process, CC Docket No. 92-296, *Report and Order* (adopted September 23, 1993, released October 20, 1993).

[75]The financial loss is manifest when the price-cap plan is renewed. Regulators must set the terms of the new plan so that the LEC has the opportunity to recover and earn a fair return on the rate base. However, the rate base is reduced if the LEC previously unilaterally increased depreciation rates. As a result, the LEC would have less bargaining leverage to negotiate favorable terms for the new price-cap plan.

## V. PRICING FLEXIBILITY

For purposes of this section, we assume that the firm's prices, other than for selected services subject to streamlined regulation, are limited by some overall constraint; *e.g.*, price caps or a ROR constraint. We then consider what limitations should be placed on the firm's freedom to restructure rates *within* the overall constraint.

Under ROR regulation, regulators generally have the power to set prices for each individual rate element. In practice, however, the firm has typically been afforded some pricing flexibility within the overall earnings constraint.

Pricing flexibility is more explicit under price regulation. The firm is free to restructure rates, so long as the new rates satisfy specific constraints. In the FCC plans, price-cap constraints must be satisfied individually for each of several specified baskets of services. In addition, changes in average prices for "services" (which are precisely defined sets of rate elements) must be within specified bands.

In analyzing pricing flexibility, we first note that the firm almost surely understands its costs and demand better than the regulator does. Consequently, rates set by the firm are much more likely to reflect actual (relevant) costs and actual market conditions than would rates set by regulators. This argues in favor of giving the firm some discretion in setting rates to achieve the economic benefits of more efficient pricing.

Absent sufficient competition or regulatory constraints, the firm may have an incentive to choose some rates that are not in the public interest. A firm with market power would obviously have the incentive to set overall rates too high, apart from regulatory constraints. Here, however, we are assuming that the firm's overall rates are limited by price-cap constraints. Thus, the issue is whether the firm, in meeting that overall constraint, has an incentive to set some rates too high and others too low.

An important academic result bears on this issue. In 1979, Vogelsang and Finsinger[76] analyzed the regulatory regime under which only the firm's overall price level is constrained;

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[76] I. Vogelsang and J. Finsinger, "A Regulatory Adjustment Process for Optimal Pricing by Multiproduct Monopoly Firms," *Bell Journal of Economics* 10(1), 1979: 157-71; see also Ingo Vogelsang, *Price Cap Regulation of Telecommunications Services: A Long-Run Approach* (Santa Monica, Calif.: The RAND corporation, 1988), vii-ix, 24-25.

that is, there are no additional constraints on individual prices or sets of prices (*e.g.*, baskets). Vogelsang and Finsinger found that the firm under this regulatory regime will tend, in the long-term, to price efficiently. Ultimately, the prices that maximize economic efficiency also maximize the firm's profits. Thus, regulatory intervention in setting individual rates cannot be justified on the basis of general economic efficiency.

There are, however, two considerations that might lead to regulatory intervention. First, economically-efficient rates might not be politically palatable. In this regard, we presume that regulators will limit the firm's freedom to raise local rates and lower long-distance rates. We have previously argued that regulators should, indeed, give LECs discretion to raise local rates where appropriate, while lowering long-distance access charges. One cannot, however, realistically propose that the firm be given unlimited freedom to restructure these rates as it chooses, without regulatory oversight.

At the local level, political concerns have led regulators in the past to price residential service low relative to business services and to price basic services low relative to discretionary services. Political constraints, apart from the SLC, are less binding at the interstate level, and the FCC has more practical freedom to price efficiently.

In all the above cases, it should be understood that restricting the firm's freedom to set rates diminishes economic efficiency in the long term. Rates set by regulators will not accurately reflect relevant economic costs and market conditions. In order to assuage political concerns, regulatory intervention imposes costs in terms of reduced productivity and makes the U.S. economy less competitive.

Competitive concerns also provide a legitimate rationale for regulatory intervention. The incumbent firm, if unconstrained, may choose to charge too high a price for interconnection services and other essential inputs used by competitors. Regulators must limit the firm's freedom simultaneously to raise these prices, while lowering output prices.

Similarly, the firm might choose to price services that are subject to intense competition below marginal cost if it could simultaneously raise prices of services that are subject to

less intense competition.[77] Regulators may, therefore, choose to limit the firm's freedom to restructure rates in this way.

Under ROR regulation, these concerns would be addressed on a case-by-case basis. Under price caps, undesired price restructuring is limited by baskets and bands. Creating the following set of baskets would suffice to meet the above-mentioned goals:

1) Politically sensitive services and interconnection charges;

2) Other noncompetitive services;

3) Emerging competitive services; and

4) Competitive services (subject to streamlined regulation, not subject to price-cap regulation).

Pricing flexibility would be explicitly limited in Basket 1. Individual rate elements could be governed by specific regulatory guidelines. As previously discussed, economic efficiency and productivity will be greater, the fewer "politically-sensitive" services are included in this basket.

Interconnection prices should be set so as to avoid the possibility of a vertical price squeeze. In general, if charges to competitors for use of essential facilities embody a contribution over and above cost, the same contribution should be imputed to the incumbent firm's output prices.[78]

Basket 4 services should not be subject to price regulation. They should receive streamlined treatment, as previously discussed. Competitive forces, rather than regulation,

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[77]This is a traditional regulatory concern, but it is far from clear that the firm has any profit incentive to price in such a way. *See* Michael A. Einhorn, ed., *Price Caps and Incentive Regulation in Telecommunications*, Kluwer Academic Publishers, 1991, p. 234. In any event, regulatory policies that prevent the firm from pricing below marginal cost do no economic harm, apart from regulatory delays and administrative costs.

[78]This rule is consistent with static profit maximization. It limits the regulated firm's freedom to sacrifice profits in a way that reduces the scope of competition. For fuller discussion of this issue, *see* William J. Baumol, *Deregulation and Residual Regulation of Local Telephone Service*, AEI Studies in Telecommunications Deregulation (March 3, 1993) and William J. Baumol and J. Gregory Sidak, *Toward Competition in Local Telephony*, (Cambridge, MA, MIT Press, 1994), Chapter 7, "The Pricing of Inputs Sold to Competitors," pp. 93-116. When effective competition exists for all inputs in a particular market, no facilities are essential.

should be relied upon to protect consumers. Basket 4 would also include discretionary services, as described earlier.

Basket 3, emerging competitive services, would include services that face some competition, but do not yet meet the conditions for streamlined regulation. Basket 2 would include services that face no competition.

The regulated firm should be allowed substantial pricing flexibility in both Baskets 2 and 3. Since the baskets are separate, there is no danger of using noncompetitive services to subsidize emerging competitive or competitive services. There is no danger that emerging competitive services can be used to subsidize competitive services.[79]

The general principle is that markets should be separated, based on the extent of competition and/or whether the services are discretionary. Then, pricing flexibility can be afforded to *all* services (except Basket 1) — not just the more competitive services. Pricing flexibility leads to more efficient pricing even for noncompetitive services — once the dangers of cross-subsidy or a vertical price squeeze are averted through the use of separate baskets and maintenance of efficient price spreads.

To implement this basket structure effectively, one needs to substantially disaggregate services across markets. Some services will face competition only in selected geographic areas. Ideally, the service should be deemed competitive or emerging competitive only in geographic areas where competition actually exists. In other areas the service would be deemed noncompetitive. Since competition is growing so rapidly, the services to be included in each basket should be reviewed every year. Over time, more and more services would be assigned to the emerging competitive and competitive baskets, as competitors enter new markets and grow in their existing markets. Each year, the companies should be given a chance to disaggregate services; so some markets for a service (e.g., the service in particular geographic areas) can be placed in the competitive basket.

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[79]In formal economic terms, cross-subsidy occurs when some services are priced above stand-alone costs, while other services are priced below incremental costs. The former services subsidize the latter. If under the initial rates, neither basket subsidizes the other, the basket constraints prevent the firm from restructuring rates so that one basket subsidizes the other. Basket constraints also preclude many types of price-restructuring that do not involve cross-subsidy

# VI. CONCLUSIONS

In recent years, many regulators have realized that rate-of-return regulation is wholly inappropriate for the telecommunications industry. A different approach is needed, as the industry enters the Information Age. The FCC and state regulators have tried many different versions of regulatory reform. Results have generally been successful. Incentive regulation has been an appropriate step in the right direction. Further steps in the same direction could yield much larger public benefits. To reap those benefits, regulators must avoid resting on their laurels by simply fine-tuning existing plans. What is called for are bold *new* steps to further regulatory reform.

This paper presents a vision of where regulation should be 5 years from now. Because of inevitable procedural delays, progress must begin immediately if this goal is to be achieved. The vision provides a compass for evaluating shorter-run reforms. We also suggest some specific short-run reforms that would significantly move regulation in the direction of our long-run vision.

## A. Growth in Competition

Any plan for regulatory reform should anticipate and facilitate changes in the market by providing appropriate regulatory flexibility. Local telecommunications is currently undergoing profound changes that will revolutionize the industry structure. Removal of state and federal regulatory barriers to entry is fueling growth in competition. Technological and policy developments will strengthen the array of competing services. Competing access providers (CAPs), cable and wireless services industries are already thriving and hold excellent prospects for the future.

CAPs have for some time succeeded in bypassing local exchange carriers (LECs) by directly connecting private facilities to long-distance carriers. Now, by taking advantage of new interconnection opportunities, they can offer switched access and local services as well. With their established presence in most major markets and their substantial financial resources, CAPs are poised for large-scale, head-on competition with LECs.

Competition from the cable industry will also intensify in the near future. The number of homes passed and number of homes served by the cable industry have both grown rapidly. Cable now has a large presence in residential areas. Increased use of fiber in cable networks positions the cable industry to provide local exchange services at low incremental cost. The recent spate of proposed mergers and other joint arrangements between LECs and cable companies portends an acceleration of competition jointly by cable companies and out-of-region LECs.

The wireless industry will soon bring a vast new universe of competition to local services. The rapid growth of cellular telephony demonstrates the popularity of mobile communication. Advances in digital technology will allow additional capacity for increased traffic. The FCC has adopted a policy of expediting Personal Communication Service (PCS) deployment, and recently decided to increase the spectrum available for wireless technology by four-fold. These and other developments (*e.g.*, Motorola's sale of spectrum to Nextel) will drive down the price of wireless service and equipment. We expect that within 10 years, wireless services will provide reasonably-priced alternatives to LEC landline services. The entire landscape of the telecommunications industry will be transformed as a result.

In sum, LECs will face increasingly potent competition. Growth of local-services competition is likely to far outpace the early growth of long-distance competition.

## B. Efficiency Incentives

Effective plans for reform also must take into account the incentives for efficiency under different regulatory scenarios. Under traditional rate of return regulation, the company is allowed an opportunity to earn a "fair" return on operations. While providing some benefits, this method of regulation significantly dilutes the firm's incentives to be efficient. Increased efficiency often requires difficult changes in established business and personnel patterns. Without a sufficient financial incentive, such changes are unlikely to be made. Our measurements indicate that rate-of-return regulation (with a one-year lag) affords only a small percentage (about 14 percent) of the efficiency incentives that exist in unregulated competitive markets. Greater incentives can be provided through alternative regulatory approaches.

## 1. Price Regulation

### a. Current price caps

Direct price regulation is one alternative approach to rate-of-return regulation. Price regulation plans currently in operation typically last only 3 to 5 years. The aggregate price level (for services not subject to streamlined regulation) is limited by a price freeze or a predetermined formula. The allowable price level changes each year, in accordance with the formula. However, the formula itself does not change during the term of the plan. Price-regulation plans benefit customers through lower rates during the plan's term (i.e., the consumer dividend). However, renegotiations at the end of the plan term substantially dilute efficiency incentives. Moreover, the shorter the term of the plan, the more are incentives diluted. In addition, some current price-cap plans incorporate a sharing mechanism whereby prices are adjusted on the basis of the firm's earnings. Such plans are hybrids between "pure" price caps and rate-of-return regulation. Such mechanisms further dilute incentives and are counterproductive. We estimate that current FCC hybrid price-cap plan for LECs provides *less than* 35 percent of the efficiency incentives that exist under unregulated competition. Marginal efficiency incentives in the hybrid plan are only about 18 percent for a LEC whose earnings are in the sharing zone each year.

### b. Potential improvements

While current price-cap and hybrid plans are somewhat better than rate-of-return regulation, substantial further improvement is possible and desirable. There should be no earnings sharing mechanisms, and the term of the plan should be lengthened to 8 to 10 years. Such a term optimizes the trade-off between the higher risk of a long-term plan and the diluted incentives of a short-term plan. Significantly more incentives for efficiency could be preserved with these improvements than under current plans.

## 2. Streamlined Regulation in Selected Markets

Streamlined regulation in selected markets is another alternative approach to regulation. Under streamlined regulation, the firm must file tariffs. However, regulators do not (in practice) regulate the firm's prices or earnings. Streamlined regulation provides the full efficiency incentives of competition. Competitive and market pressures are relied upon to limit market power of any firm.

The standard for streamlining regulation in a market should be whether customers who constitute a sizable fraction of demand have reasonable alternatives. This standard is superior to a test of market share, which has limited value as an index of market power, and may create perverse incentives for providers.

Efficiency benefits are maximized when regulation in all appropriate markets is streamlined. To that end, LECs should be allowed to disaggregate services to create additional candidates for streamlining. Discretionary services, including new services that supplement existing services, should be under streamlined regulation. Consumers can check abuse of market power by cutting back purchases of discretionary services if prices are raised or quality declines. Balancing efficiency incentives versus risk, we estimate that the pricing formula (for services not subject to streamlined regulation) should be renegotiated, if necessary, every 8 to 10 years.

Some LEC markets (*e.g.*, special access in some markets, primarily in large metropolitan areas) should already be deregulated or subject to streamlined regulation. Regulation of much of the transport market should be streamlined shortly after collocation is implemented. Over the next several years, as competition becomes much more intense, deregulation or streamlined regulation should apply to a sizable portion of LEC revenues.

## C. Impacts of Inefficient Pricing

Future regulatory policy should mitigate the perverse effects of inefficient pricing schemes that have been imposed by regulators in the past. These inefficient pricing schemes, while perhaps useful in the past, are currently poor public policy. Their impact will become increasingly counterproductive as competition intensifies during the next decade.

Inefficient pricing has been promulgated in two ways. One is through overpricing of long-distance services (including long-distance access) in order to underprice local services. This arrangement was implemented to achieve the goal of universal service. That goal has long been achieved. Consequently, interstate access rates should no longer be burdened with an inappropriately high level of support. Access rate reductions benefit a broad base of consumers as long-distance rates are lowered. Lower long-distance access rates which reflect actual cost of access would stimulate use of long-distance service and benefit consumers. Efficiency improvements would be enormous. Additionally, inefficient pricing has the drawback of encouraging entry of inefficient competitors. Even inefficient competitors can easily undercut access rates that are padded by regulators to include noneconomic costs. Access rates should be restructured before competitors, attracted by current inefficient prices, make sizable investments. However, restructuring should follow a transition plan that is both economically and politically acceptable. That plan should incorporate a mechanism for contributions by competitors toward funding the inefficient pricing regime.

The other form of inefficient pricing is underdepreciation of plant. In high-tech industries, plant value declines rapidly due to rapid obsolescence of high-tech equipment. However, regulators have not allowed telephone companies to depreciate plant in pace with the rapid decline in plant value. As a result, unregulated high-tech firms have much more accelerated depreciation than telephone companies. The problem of underdepreciation has not abated in recent years. On the contrary, it has been exacerbated slightly under current price-cap regimes. Regulators and companies should agree on an accelerated schedule for reducing the regulatory book value of assets as part of a revised price-cap plan. Because the devaluation of assets would reduce reported earnings, regulators would *(ceteris paribus)* need to make concessions elsewhere in the plan.

## D. Pricing Flexibility

Prices of services not subject to streamlined regulation will presumably have an overall constraint. The LECs' freedom to restructure rates *within* that constraint will affect performance. Additional pricing freedom can yield additional benefits. Because the firm itself is most knowledgeable about actual costs and market conditions, it is best able to set rates efficiently. Recent economic analyses establish that, in the long term, a firm subject only to an overall pricing constraint will tend to price efficiently. However, there may still be a call for some limiting of pricing flexibility. Regulators may want to impose rules to reduce barriers to competitive entry. They may also seek goals other than efficient pricing. For example, regulators may seek moderation of politically sensitive rates, such as for low-income residential customers, even at the expense of economic efficiency.

Price caps can best protect the several public policy goals of regulation by segregating categories of services into relatively few "baskets" which are defined primarily by degree of competition. Each "basket" should be subjected to an appropriate level of regulation. To maximize efficiency, the "baskets" should undergo annual review, to ensure that services are categorized appropriately, as competitive conditions change. Each year, regulation would be streamlined in additional markets, as competition intensifies.

## E. Vision of Future Regulation

The preceding analysis leads to our vision of where regulation should be in 5 years; *viz*:

1. In markets where customers have reasonable alternatives to the regulated firm's services, the services are deregulated or regulation is streamlined. In those markets, the firm's prices and earnings are not, in practice, regulated. A process is in place for quickly streamlining regulation in additional markets, as competitive alternatives evolve. Within 10 years, a sizable portion of local exchange markets are subject to streamlined regulation or deregulation.

2. Services not subject to streamlined regulation are governed by price regulation — not traditional rate-of-return regulation. During the term of the plan, the

regulated firm's prices are not tied to its earnings. The pricing formula is renegotiated, if necessary, 8 to 10 years in the future.

3. Regulatory policies that promote inefficient pricing have been phased out to the extent possible. Regulators do not attempt to hold long-distance prices artificially high in order to underprice local services. Depreciation policies ensure that the book value of plant approximates its economic value.

4. Regulated firms have substantial flexibility to set individual prices, subject to a few overall constraints. Price-cap constraints limit the overall level of prices.

Policymakers must start now to implement these policies over the next few years if the United States is to be well-positioned to lead the world into the Information Age. If policy-makers delay even a few years in getting started — and then face lengthy procedural delays — the required changes will involve substantial dislocations. Unnecessary costs will be incurred, and the nation's technological progress will be retarded.

# APPENDIX

# MEASUREMENT OF EFFICIENCY INCENTIVES

In this Appendix, we develop a method for measuring the efficiency incentives embodied in price-cap plans of various durations. We first discuss the general model and express it in the form of equations. The final section of the Appendix discusses our estimates of model parameters.

## General Model

We use the standard procedure of adjusting for inflation and expressing all dollar quantities in real terms. We assume that the firm, in making decisions, discounts future cash flows at a real discount rate $d$. Thus, cash received $j$ years in the future is weighted by the discount factor $(1\text{-}d)^j$. The discount factor $d$ is the firm's real cost of capital (*i.e.*, the nominal opportunity cost of capital less the rate of inflation), assuming that the firm attempts to maximize the firm's value in financial markets.

We assume that efficiency improvements last $m$ years. That is, efficiency improvements made in the first year last through the *mth* year. *Ceteris paribus*, the firm's efficiency in this model would decline after the *mth* year, when the benefits of the first year's efficiency improvements lapse. However, efficiency improvements made in year $m$ may be large enough to allow overall efficiency to continue increasing over time.

We assume that the firm grows at a rate $g$. We further assume that the benefits of efficiency gains grow proportionally with the size of the firm. Suppose, for example, that an efficiency improvement lowers unit cost. We assume that the lower unit cost applies to the firm's total output for the next $m$ years — not just the level of output in the first year. This assumption implies that an efficiency improvement which yields benefits of 1 in year 1 will yield benefits of $(1+g)$ in year two, $(1+g)^2$ in year 3, etc.

## Equations

To develop our measure of efficiency incentives, we assume the efficiency improvements occur throughout the period. We choose units so that efficiency gains are 1 in the first period. We assume that new efficiency improvements in the *ith* period equal $(1 + g)^{i-1}$ for $i \leq m$. These new gains are over and above the continuing gains from efficiency improvements made in previous years.

The present discounted value of all the efficiency gains is

$$\sum_{i=1}^{n} \sum_{k=0}^{m-1} [(1 + g)\ (1 - d)]^{i+k-1} \qquad (1)$$

where,

$n$ = the term of the price-cap plan, and

$k$ = the number of years after a particular efficiency improvement is made.

In an unregulated, competitive market, these gains would all be retained by the firm.

## Pure Price Regulation

Under limited-term price caps, the gains retained by the firm are truncated. They are as follows for pure price regulation:

$$\sum_{i=1}^{n} \sum_{k=0}^{h} [(1 + g)\ (1 - d)]^{i+k-1} \qquad (2)$$

where,

$h$ = the minimum of $\{m - 1, n - i\}$.

In Equation (2), the firm gets to keep the efficiency gains until they lapse or until the end of the price-cap period — whichever comes first.

In this formulation, we conservatively assume that regulators fully understand and adjust for the lapsing of efficiency gains. In reality, that may not be the case. For example, suppose a firm is subject to one-year price caps (or equivalently, the FCC mode of ROR regulation). Suppose that the firm makes a one-time cost saving ($m = 1$). The regulator, observing the lower costs due to a nonrecurring event, could conceivably lower rates in the second year. Since the one-time efficiency gain has lapsed, the firm does not cover its costs in year 2. Indeed, the firm's losses in the second year would essentially cancel out the gains in the first year. The overall result is that the firm has no incentive to undertake the one-time cost-saving measure.

In our formulation, we assume that regulation is not administered in this short-sighted manner and that the firm keeps the efficiency gains during the term of the plan, with no penalty after the plan ends. More generally, our measure of efficiency incentives is conservative to the extent that regulators do not fully adjust for the lapsing of efficiency gains. That is, our method *overestimates* the efficiency incentives for limited-term price-cap plans.

Our efficiency measure is the ratio of Equation (2) to Equation (1); *i.e.*

$$\frac{\sum_{i=1}^{n}\sum_{k=0}^{h}[(1+g)(1-d)]^{i+k-1}}{\sum_{i=1}^{n}\sum_{k=0}^{m-1}[(1+g)(1-d)]^{i+k-1}} \qquad (3)$$

It is the ratio of the efficiency incentives under price caps relative to those provided by unregulated competitive markets.

Assuming that $d > g$, Equation (3) approaches unity for large $n$. Thus, indefinite-term price caps provide the same maximal incentives that are provided in an unregulated competitive market.

Equation (3) is less than unity for all finite $n$. That is, all limited-term price-cap plans provide weaker efficiency incentives than supplied by unregulated competitive markets.

## Price Caps with a Sharing Mechanism

Many price-cap plans have a sharing mechanism. Under such mechanisms, prices are usually adjusted upward or downward, each year, depending on the firm's earnings the previous year. Sharing generally applies only when the firm's rate of return is within certain ranges.

In our model, we assume that the firm is in the sharing range, and we consider marginal efficiency improvements. Each year after the first, prices are reduced by the marginal efficiency gain times the sharing fraction. The efficiency gains retained by the firm are:

$$\sum_{i=1}^{n}\sum_{k=0}^{h}[(1+g)(1-d)]^{i+k-1} - s\sum_{i=1}^{n}\sum_{k=0}^{h}[(1+g)(1-d)]^{i+k} \qquad (4)$$

where,

$s$ = the sharing fraction.

Since sharing occurs the year after the efficiency gains occur, the adjustment incorporates an extra year of growth and discounting. Hence, the experiment is $i+k$, not $i+k-1$.

The ratio of efficiency gains under price caps with sharing to those under unregulated competition is:

$$\frac{\sum_{i=1}^{n}\sum_{k=0}^{h}[(1+g)(1-d)]^{i+k-1} - s\sum_{i=1}^{n}\sum_{k=0}^{h}[(1+g)(1-d)]^{i+k}}{\sum_{i=1}^{n}\sum_{k=0}^{m-1}[(1+g)(1-d)]^{i+k-1}} \qquad (5)$$

## Estimation of Parameters

Equation (3) contains three parameters that need to be estimated:

1) The firm's real opportunity cost of capital ($d$);

2) The firm's growth rate ($g$); and

3) The duration of efficiency improvements ($m$).

Our procedures for estimating these parameters is discussed below. The estimates are approximate and are intended only to provide broad guidelines for evaluating alternatives for regulatory reform. These estimates suffice to establish our main points that efficiency incentives are far too weak under short-term price-cap plans and that the problem gets worse if there is an additional sharing mechanism.

## The Firm's Real Cost of Capital

We use the FCC's target ROR for ROR LECs less the inflation rate as a reasonable proxy for the firm's real cost of capital. The FCC reset the LECs' target ROR to 11.25 shortly before instituting price caps for LECs. At that time, the inflation rate, measured in terms of the GNPPI, was slightly above 4 percent per year. The difference between the allowed ROR and the inflation rate was about 7 percent per year. That is our estimate of the firm's real opportunity cost of capital.

## Growth Rate

We use the growth rate of interstate switched access minutes as our proxy for the firm's growth. This is a reasonable measure, as applied to interstate regulation of LECs. Different growth rates would be appropriate for application to state regulation.

We use the annual rate of growth from 1989 to 1992. Earlier years are less indicative of future growth, since the industry was not under price caps, and switched access prices were rapidly declining because of imposition of the Subscriber Line Charge.

Growth of interstate switched access minutes was between 6 and 7 percent per year from 1989 to 1992. At the same time, real price declines of 3.3 percent were guaranteed by the price-cap plan. The difference between these two rates (about 3 percent per year) is the growth rate of the *real value* of output. We use that net growth rate in developing our measure of efficiency incentives.

## Average Duration of Efficiency Gains

A variety of activities of the firm may improve efficiency. The duration of the efficiency gains varies from activity to activity.

Efficiency gains may relate to the deployment of new technology. The duration of such gains is the economic life of the equipment that embodies the new technology. The economic life of fiber optic cable probably exceeds 10 years. Other equipment that embodies new technology (*e.g.*, digital switches or circuit equipment) have shorter lives; *e.g.*, 5 to 10 years.

Another type of efficiency gain is the introduction of a successful new service. The duration of the gain would be the life of the service. Service lives can be very long. Custom calling was introduced in the 1970s and is still offered today. CLASS services will probably be offered long into the future.

Efficiency may also be improved by redefining job functions of management and/or labor. This may involve retraining personnel, relocating personnel and/or reducing the work force. The efficiency gains from such activities typically last for some time. However, the telecommunications business is rapidly changing, and before too long, jobs will need to be redefined again. Efficiency gains of this type probably last for only 3 to 5 years.

The average duration of the gains from all these diverse activities probably lies somewhere in the range of 5 to 10 years. We use 8 years as a reasonable rough approximation.

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